

# May Measurement Month 2017: Results from Taiwan—East Asia

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Elevated blood pressure (BP) is a growing burden worldwide, leading to over 10 million deaths each year. May Measurement Month (MMM) is a global initiative aimed at raising awareness of high BP and to act as a temporary solution to the lack of screening programs worldwide. Given the consistent 30% unawareness rate across all hypertension surveys in Taiwan, we collaborated with the International Society of Hypertension to launch the MMM campaign. An opportunistic cross-sectional survey of volunteers aged  $\geq 18$  was carried out in May 2017. Blood pressure measurement, the definition of hypertension and statistical analysis followed the standard MMM protocol. Over 1200 community pharmacies joined in this campaign, where participants were recruited to obtain BP measurements using automated oscillometric sphygmomanometers. Triplicate BP readings of right or left brachial artery were obtained after sitting for 10 min. A total of 52 514 individuals were screened during MMM17. After multiple imputation, 28 123 (53.8%) had hypertension. Of individuals not receiving antihypertensive medication, 5226 (17.8%) were hypertensive. Of individuals receiving antihypertensive medication, 8121 (35.7%) had uncontrolled BP. As compared with underweight individuals, adjusted systolic BP and diastolic BP raised by 6.1 and 4.1 mmHg, respectively, in overweight ones; while by 9.4 and 5.6 mmHg, respectively, in obese ones. May Measurement Month(MMM)17 was the largest BP screening campaign undertaken in Taiwan. The substantial numbers of unidentified and uncontrolled hypertensive patients, though lower than prior surveys in Taiwan, are challenging. Whether the continued MMM campaign would raise hypertension awareness at the national level awaits verification.

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## Background

Hypertension is the most important modifiable risk factor for cardiovascular and cerebrovascular complications worldwide, as well as in Taiwan. According to the report of the nationwide 2002 Taiwanese Survey on Hypertension, Hyperglycemia, and Hyperlipidemia, the age-standardized prevalence of hypertension was 23.5% (men 27.1%; women 20.2%) in people aged 19 years or above.<sup>1</sup> The awareness and control rates of hypertension in that survey were 55.8% and 21.0% in men, and 73.6% and 28.5% in women,

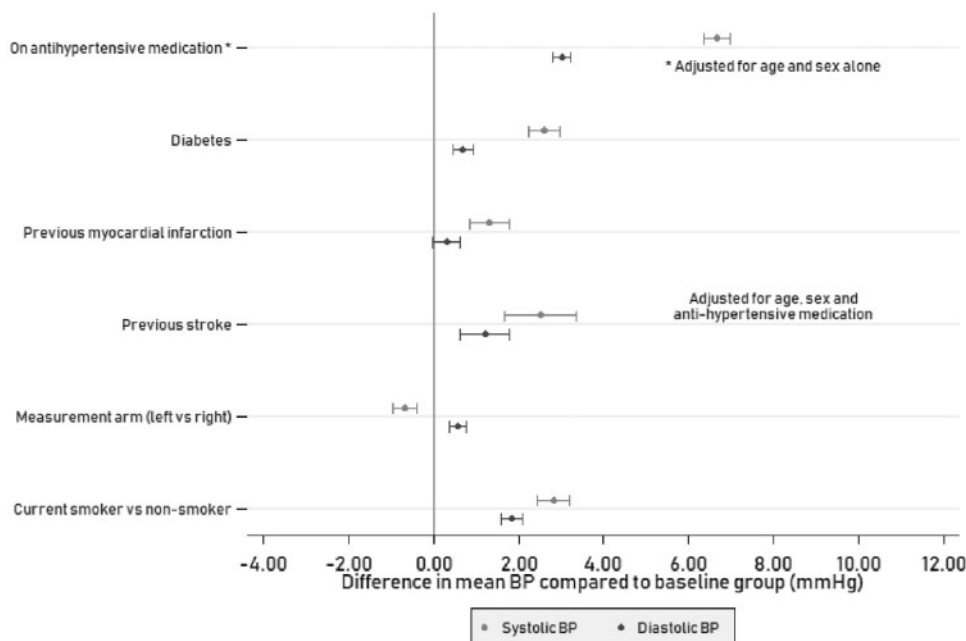
respectively. In the Nutrition and Health Survey in Taiwan conducted from 2013 to 2015, the prevalence of hypertension was 25.6% (men 29.0%; women 22.4%) in people aged 20 years or older. The awareness of hypertension remained suboptimal: 64.0% in men and 76.3% in women. Likewise, 23.7% of adults in the survey had not taken any measurement of blood pressures (BPs) in the previous 1 year.

Regarding the mortality statistics relevant to hypertension in Taiwan, the numbers of death due to cardiovascular, cerebrovascular, and hypertension were 87.6, 49.9, and 25.8 per 100 000 people and ranked second, fourth, and eighth, respectively.

Given the substantial burden of hypertension-related vascular diseases and the persistently suboptimal

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**Figure 1** Difference in mean blood pressure according to individual characteristic from linear regression models, adjusted for age, sex, and antihypertensive medication.

awareness of hypertension, we collaborated with the International Society of Hypertension to launch the May Measurement Month (MMM) campaign of BP measurement in community pharmacies all around Taiwan to advocate self BP monitoring in an out-of-office setting, which is of paramount importance in improving awareness and, thus, control of hypertension.

## Methods

The Taiwan Hypertension Society (THS), along with the Taiwan Health Promotion Administration and the Taiwan Pharmacist Association (TPA), held the campaign of BP measurements in May, 2017 in about 1200 community pharmacies across Taiwan, of which 41.7% were located at northern Taiwan, 28.4% at central Taiwan, and 27.1% at southern Taiwan. The campaign was funded by THS and TPA. The study protocol was approved by the Research Ethical Committee of the National Taiwan University Hospital.

Through fliers, posters, press conference, and online news release, adults aged 20 years or above were recruited to participate in the campaign if their informed consent was obtained. Before performing BP measurements, participants filled in an anonymous structured questionnaire consisting of the self-reported body height and weight, medical history, and lifestyle habits. After sitting for 10 min, BP's of right or left brachial artery were measured by themselves or with the help of community pharmacists using an automated oscillometric sphygmomanometer. Triplicate BP readings were taken with spacing each 1 min apart. Hypertension was defined as systolic BP  $\geq 140$  mmHg or diastolic BP  $\geq 90$  mmHg or on antihypertensive treatment. The extent of obesity was defined as follows: underweight, if body mass index was lower than  $18.5 \text{ kg/m}^2$ ;

healthy weight, if between  $18.5$  and  $24.9 \text{ kg/m}^2$ ; overweight, if between  $25.0$  and  $29.9 \text{ kg/m}^2$ ; obese, if  $30 \text{ kg/m}^2$  and more. Data were analysed centrally by the MMM project team.<sup>2</sup>

## Results

There were 57 823 adults participating in this campaign, and 52 514 (90.8%) participants qualified for analysis with a mean age of  $56.8 \pm 16.1$  years. Of those, 50.6% were women, 100% were of Chinese ethnic origin, and 43.6% took antihypertensive medications. In participants not receiving antihypertensive treatment, systolic BP levels increased continuously with aging from 120 to 135 mmHg in men and from 110 to 140 mmHg in women; diastolic BP levels peaked at the age of around 55 years with values approaching 82 mmHg in men and 80 mmHg in women.

There were 47 275 participants who took BP measurement three times. Among the triplicate BP readings, the first one was the highest with a mean of 128.8/79.3 mmHg, and the last (third) one was the lowest with a mean of 126.2/77.8 mmHg. After imputation, the mean age- and sex-standardized BPs were 129.1/80.2 mmHg in individuals receiving antihypertensive medications, and 120.2/76.0 mmHg in those without antihypertensive medications.

Based on the imputed data, 53.8% ( $n = 28\,123$ ) of 52 313 participants were classified as having hypertension. Of 29 416 individuals not receiving antihypertensive medication, 5226 (17.8%) were hypertensive. Of those treated with antihypertensive medication ( $n = 22\,733$ ), 35.7% ( $n = 8121$ ) did not achieve the BP level below 140/90 mmHg.

It is noteworthy that BP levels were affected by individual characteristics and lifestyle habits. In participants taking antihypertensive medications, the age- and sex-

adjusted BPs were 6.7/3.0 mmHg higher than that in those who did not. After adjusting for age, sex, and use of antihypertensive medications, systolic BPs were raised if participants were smokers, or had medical history of diabetes mellitus, myocardial infarction, or stroke. Similar results were found for diastolic BP, except in those with prior myocardial infarction (*Figure 1*). The results revealed a linear relationship between BP levels and the extent of obesity. As compared with underweight individuals, adjusted systolic BP and diastolic BP raised by 6.1 and 4.1 mmHg, respectively, in overweight ones; while by 9.4 and 5.6 mmHg, respectively, in obese ones.

## Discussion

Among the more than 50 000 participants recruited in MMM17-Taiwan, approximately one-half was hypertensive. Among all hypertensive participants, more than 80% were treated, and of those on treatment just over one-third were uncontrolled. Compared to results of the 2002 survey in Taiwan, the control rate observed herein improved substantially, despite inherently being confounded by self-referral bias.

Given the consistent 30% unawareness rate across all prior hypertension surveys in Taiwan, community interventions to raise awareness of hypertension is of utmost importance. The annual MMM campaign, which conveys information regarding how to appropriately obtain out-of-

office BP and lasts for 1 month, provides the best solution in this regard. The collaboration between the national hypertension society and the pharmacist association in conducting the MMM campaign is a very successful model, which resulted in the largest number of participants screened, compared to all prior community campaigns regarding hypertension prevention and management in Taiwan. Whether the continued annual MMM campaign would raise hypertension awareness at the national level awaits verification.

## Acknowledgements

We sincerely thank the Health Promotion Administration, Ministry of Health and Welfare, Taiwan, the Taiwan Pharmacist Association, and pharmacists voluntarily participating this campaign for the logistic support.

**Conflict of interest:** none declared.

## References

1. Su TC, Bai CH, Chang HY, You SL, Chien KL, Chen MF, Chen HJ, Pan WH, Tseng CH, Cheng SH, Hurng BS, Hwang LC, Chen CJ. Evidence for improved control of hypertension in Taiwan: 1993-2002. *J Hypertens* 2008;**26**:600-606.
2. Poulter NR, Schutte AE, Tomaszewski M, Lackland DT. May Measurement Month: a new joint global initiative by the International Society of Hypertension and the World Hypertension League to raise awareness of raised blood pressure. *J Hypertens* 2017;**35**:1126-1128.